

CLAIMS

1. Electronic module (6) suitable for producing contactless cards (1) and/or contactless electronic labels, comprising a carrier substrate (10) for an electronic microcircuit (7), said electronic microcircuit (7) being connectable to an antenna (2) to enable contactless operation of the module (6), characterized in that the whole of antenna (2) is arranged on the module and in that it comprises turns made in the plane of the carrier substrate (10).

2. Electronic module (6) in accordance with claim 1, characterized in that said antenna (2) is made up of a spiral whose outer size is in the region of 5 to 15 mm, preferably in the region of 12 mm, whose end terminals (11,12) are connected to contact pads (13,14) of the electronic microcircuit (7).

3. Electronic module (6) in accordance with claim 2, characterized in that antenna (2) is made up of a conductor spiral comprising between approximately 6 and approximately 50 turns, the width of each turn being of about 50 to 300  $\mu\text{m}$ , the space between two contiguous turns being in the region of 50 to 200  $\mu\text{m}$ .

4. Electronic module (6) in accordance with claim 3, characterized in that the outer shape of said spiral is substantially circular, having an outer diameter in the region of 5 to 15 mm, preferably approximately 12 mm.

5. Electronic module (6) in accordance with claim 3, characterized in that the outer shape of said spiral is substantially square, with an outer side measurement ~~in the region of 5 to 15 mm, preferably~~ approximately 12 mm.

6. Electronic module (6) in accordance with claim 3, characterized in that the outer shape of said spiral is substantially oval, having a larger measurement of approximately 15 mm and a smaller measurement of approximately 5 mm.

7. Electronic module (6) in accordance with any of the preceding claims, characterized in that the microcircuit (7) is placed in the centre of antenna (2) and on the same side of module (6) as the antenna, the connection terminals (11,12) of the antenna being connected to corresponding, respective contact pads (13,14) of module (6) or of microcircuit (7) via conductor leads (15).

8. Electronic module (6) in accordance with any of claims 1 to 6, characterized in that the microcircuit (7) is placed on the same side as antenna (2) astride its turns, the connection terminals (11,12) of the antenna being connected to corresponding, respective contact pads (13,14) of module (6) and of electronic microcircuit (7) via conductor leads (15), an insulator (16) being placed between the microcircuit (7) and at least the antenna zone under the microcircuit.

9. Electronic module (6) in accordance with any of claims 1 to 6, characterized in that the electronic

microcircuit (7) is placed on the side of the module (6) with no antenna, the connection terminals (11,12) of the antenna being connected to corresponding, respective contact pads (13,14) of the module (6) or of microcircuit (7) via conductor leads (15) crossing over wells (23) made in carrier substrate (10) of the module at the level of said connection terminals (11,12) of the antenna.

10. Electronic module (6) in accordance with any of the preceding claims, characterized in that a tuning capacitor (17) is connected in parallel to terminals (11, 12) of the antenna to contact pads (13,14) of the electronic microcircuit (7), the value of capacitor (17) being chosen to obtain an operating frequency for module (6) in the range of approximately 1 Mhz to 450 Mhz.

a 11. Electronic module (6) in accordance with claim 10, characterized in that the value of <sup>the</sup> tuning capacitor (17) is in the region of 12 to 180 picoFarad, and in that the operating frequency of the module is approximately 13.56 Mhz.

A 12. Electronic module (6) in accordance with claim 10, characterized in that the value of <sup>the</sup> tuning capacitor (17) is in the region of 30 to 500 picoFarad, and in that the operating frequency of the module is approximately 8.2 Mhz.

13. Electronic module (6) in accordance with any of claims 10 to 12, characterized in that the tuning capacitor (17) is obtained by depositing oxidized

silicon on the surface ~~of~~ the microcircuit (7) previously coated with an insulator (16).

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14. Electronic module (6) in accordance with any of the preceding claims, characterized in that it comprises on one face of carrier (10) an antenna (2) connected to microcircuit (7), and on the other face of carrier (10) visible contacts (26) also connected to microcircuit (7), in such manner as to obtain a hybrid card able to be read and written on via contacts (26) and/or antenna (2).

15. Process for manufacturing an electronic module (6) in accordance with any of the preceding claims, characterized in that it comprises stages consisting of :

15 - on a substrate carrier (10) making a plane spiral antenna (2) of small size provided with connection terminals (11,12) ;

- fixing on said carrier (10) or said antenna (2) a microcircuit (7) provided with contact pads (13,14) ;

- making the electric connection between connection terminals (11,12) of antenna (2) and corresponding contact pads (13,14) of the microcircuit ;

25 16. Contactless card (1), comprising a card body (3), an electronic module (6) carrying an integrated microcircuit (7) able to be incorporated into a card body (3), and an antenna (2), characterized in that the size of said antenna (2) is substantially smaller than the size of card (1), and in that antenna (2) is a

substantially plane spiral antenna wholly arranged on carrier substrate (10) of electronic module (6).

17. Contactless card (1) in accordance with claim 16, characterized in that it is provided with an electronic module (6) in accordance with any of claims 1 to 14.

18. Process for manufacturing a contactless card (1) in accordance with claim 16 or claim 17, characterized in that it comprises stages consisting of :

- cutting out, from a carrier (8) of electronic modules, a contactless module (6) provided with an antenna (2) and a microcircuit (7) ;

- bringing said module (6) opposite an opening (9) of substantially the same size as the module, made in card body (3) ;

- fixing said module in the opening of the card body.

19. Electronic label, especially intended for object identification, characterized in that it comprises an electronic module (6) of small size, its largest measurement being in the region of 5 to 15 mm, and an electronic microcircuit (7), characterized in that it comprises an antenna (2) also of small size arranged on said electronic module.

20. Electronic label, characterized in that it is provided with an electronic module (6) in accordance with any of claims 1 to 13.

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21. Electronic label in accordance with claim 19 or ~~claim 20~~, characterized in that the electronic module (6) provided with its microcircuit (7) and its antenna (2) is fixed on or integrated in a carrier, so that the label may be made part of an object to be identified.

22. Process for manufacturing an electronic label in accordance with any of claims 19 to 21, characterized in that it comprises stages consisting of :

- out of a carrier (8) of electronic modules (6) cutting out a contactless module (6) provided with an antenna (2) and a microcircuit (7) ;
- integrating said cut-out electronic module into a protective support.

23. Process for manufacturing an electronic label, characterized in that it comprises solely the stage consisting of cutting out an electronic module (6), in accordance with any of claims 1 to 14, from a contactless card (1) incorporating such module, in such manner as to leave some substance of card body (3) around the electronic module (6), for the purpose of protecting the module.

24. Process for manufacturing an electronic label, characterized in that it subsequently comprises the stages consisting of :

- cutting out from a contactless card (1) a first element (28) incorporating an electronic module (6) in accordance with any of claims 1 to 14, to a

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given shape so as to leave substance around the module ;

- cutting out from a card, preferably the same contactless card (1), a second element (29) having the  
5 same shape as said first element ;

- assembling said first and second elements (28,29) in such manner that electronic module (6) is incorporated between said elements and protected by the latter.

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